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(Up Stairs.)

Nov. 15 1838. Dec. 1

☞ It is to be distinctly understood, *that for the period from January to July of the current year*, 1838, no numbers of the Journal will be issued; and that the volume will commence with 1st *July*, 1838.

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MOSES LONG.

Rochester, N. Y., Sept. 13, 1838.

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DAVID HAMILTON,
Superintendent repairs, Erie Canal.
W. J. Mc ALPINE,
Assistant Engineer Erie Canal Enlargement.
J. HOUGHTON,
Engineer Cohoes Company.

Cohoes, December 16, 1837.

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New-York, March 10, 1838. 3t

AMERICAN RAILROAD JOURNAL, AND MECHANICS' MAGAZINE.

No. 10, Vol. I. New Series.] NOVEMBER 15, 1838. [Whole No. 322. Vol. VII.

The arrival in our country of the Chevalier Francis Anton Von Gerstner, a distinguished continental Civil Engineer, will afford our professional friends an opportunity of receiving from him much valuable information, and of extending to him those courtesies with which they so uniformly receive their Trans-Atlantic brethren.

The Chevalier Von Gerstner is well known as the author of one of the earliest treatises upon Railroads, published originally in German; and since, for his construction of the first Russian Railroad, and others in Germany. His object in visiting our country is to obtain information as to the construction and management of our Railroads.

During a temporary indisposition, an article containing a description of the Philadelphia and Reading Railroad, and which we intended to incorporate with other matter, found its way accidentally to the printer, and thence into our columns, without any notice or credit. We owe an apology to the writer, Mr. G. A. Nicholls, Resident Engineer of the Road, for this unintentional omission. It contains much valuable information in a condensed form, and is well worth the attention of our readers.

We shall feel obliged to Mr. N. for any other communications which he may make relative to this Road.

Eight-wheel Cars.

Much as this description of Railroad Car is in repute in the Southern, and a portion of the Middle States—yet in this State, and East of us, there is a singular prejudice in favor of the four-wheel cars, and against the new form.

This same prejudice operated against their introduction upon some of the Southern Roads, but experience has led to the entire abandonment of the old form.

In the first place, the accommodation for an equal number of passengers costs less in long cars than in the short ones. We will suppose the case of an eight-wheel car just double the length of a four-wheel car; there will then be the same length of side in either case, but the two short cars have the additional cost of two more ends, and their entire fixtures.

The arrangement, however, is generally such, that the length of the eight-wheel cars is more than double those of the short ones; there will then be fewer wheels in a train, and moreover the same number of passengers will be carried in a train of less length.

This question of cost has been settled by the investigations of the Baltimore and Ohio, and other Railroad Companies. They had been induced to believe there was economy in the use of short cars, and sent competent engineers to collect information on this subject. The result was, that the price of the eight-wheel cars was found to be much less than for the same accommodations in the short cars. This is reasonable enough, and the only wonder is that the fact should have been doubted.

There are, however, still more important considerations to be taken into account. In the four-wheel cars, the support furnished by the wheels is very near to the centre of the length, and the overhanging weight at each end acts upon a considerable purchase, to strain the centre of the car, and twist it on the trunk. The consequence is, that the rails are pushed apart by the swinging motion thus produced, the wheels are worn, and the whole machinery racked. The narrowness of our Railroad tracks adds to the amount of the mischief—and the longer the cars are, the worse the effect.

In the eight-wheel cars, the weight is contained more between the points of support than on each side, and the consequences are directly the reverse. The motion is easier to the passengers, the cars and the road suffer less. Besides, there is more spring in the long cars when thus supported, and the difference is again in favor of them.

As to the comparative safety, there appears to be no doubt: a car having four wheels near to the centre, when one is broken cannot well be supported on the three remaining ones, particularly when heavily or unevenly loaded. An eight-wheel car, on the contrary, may lose one, or even two, and yet remain upon the track. And in general, when there is any obstruction, they are not so easily thrown off the track as the four-wheel cars—of this fact we have had repeated illustrations.

Again, in turning curves, the long cars are preferable to the short ones,

producing less lateral friction, and therefore accommodating themselves to the curves with much greater facility. We have seen a train of three 40 to 50 feet cars drawn through a curve of double curvature, of about their own length, and of short radii, with perfect ease, by three horses, when the same number of passengers in short cars could not have been started. This great advantage is so little understood, that the commonest objection to the long cars is the difficulty of handling them at the depots.

We most sincerely hope that these, and many other circumstances in favor of this form of car, may be duly considered before the selection of cars by companies about commencing operations.

We have examined, with much satisfaction, the various models of long cars, as produced by different makers, and shall some other time refer to them.

We are much indebted to Col. Aycrigg, for his minute account of the Kilsby Tunnel. We really hope that his example may tempt others to go and do likewise. There are many professional gentlemen who have much valuable information of this kind on hand, and we shall take the liberty of "calling them out," before long, if we do not soon hear from them.

Description of the Mode of Constructing the KILSBY TUNNEL, *on the London and Birmingham Railroad; communicated by* LT. COL. B. AYCRIGG, *one of the Chief Engineers of the State Works of Pennsylvania.*

Farrandsville, Lycoming County, Pa., Nov. 2, 1838.

To the Editors of the Railroad Journal and Mechanics' Magazine.

GENTLEMEN—The following extract from a statement of the expense and manner of tunnelling, just drawn up at the request of an Engineer having charge of a similar work to be constructed, will, doubtless, in some points at least, be interesting to most of your professional readers, and requiring on my part no other labor than that of copying, since the information previously existing in the memory (excepting the numbers) has been committed to writing, I send it to you for insertion in your Journal, should you think proper to add this to the common stock, and thereby induce others to go and do likewise.

The description of the mode of working the Kilsby Tunnel is from my own observation, having through the kindness of Robert Stevenson, the Chief Engineer of the London and Birmingham Railroad, had every avenue to information thrown open to me, and in this case having descended several shafts to see the work in all its stages, from the commencement at the shaft to its completion in joining two finished pieces—a very interesting examination professionally, but in other respects a dirty, wet, and disagreeable tour. Descending 140 feet in skeps covered with dirt or brick dust, climbing ladders, crawling among timbers and through holes, sometimes on hands and knees, and sometimes *snaking* yourself along, as our backwoodsmen say, without the use of your legs,

among the mud and wet, occasionally striking your head against the beams—while all your attention is devoted to getting a good foot-hold, in the uncertain light of a small taper. A miner on one side gruffly says, he'll "drink your health"—some one on the other informs you, that it is very cold and wet work—while, for fear that you may overlook something important, two or three of the foremen or inspectors, when they find you come there "by authority," fasten themselves to you like so many leeches. I was favored with no less than three, who accompanied me into half a dozen shafts, and understood perfectly the division of labor, each in his turn explaining something that had perhaps been explained before—until at last you leave the work, wet, dirty, hungry, with your head full of information and your pockets light of loose change, in spite of the regulations of the company against spunging.

To enable you to descend into this nether world, the skep is raised out of the shaft, and a trap door, running on rails, on each side, is shoved over the mouth of the shaft. You step into the basket, and hold on to the rope, the trap door is removed from under you, and you *hang*, like a felon, over a pit 140 feet deep, and would fare as badly as a felon should you lose your hold. But the depth and danger become insignificant, when compared with others that you must experience, if you would see every thing connected with underground engineering. As in my own case, myself and the engineer or coal viewer, as they are called, came within a minute of being crushed under the falling roof of one of the abandoned drifts in the Monkwearmouth Colliery, 1500 feet below the level of the ocean, (depth from surface of ground, 1668 feet), as we were suddenly arrested in our progress by a thundering noise ahead, and obliged to make a hasty retreat in the opposite direction, walking in the shape of fish-hooks, to keep from touching the loose rocks that hung in festoons over our heads, ready to fall with a trifling jar. In another instance, while ascending from one of the Salt Mines, at Northwich, 360 feet deep, there were six persons hanging around the bucket, or rather standing inside and on the edges, when from the conduct of a drunken visiter, the miner who accompanied us trembled like a leaf, and became so weak from fear, that he could hardly hold on till he reached the top, at the same time begging the man to be quiet. But these, and a variety of other risks and adventures, belong rather to a literary than a scientific journal, and I will therefore proceed to the extract in question, describing the manner of constructing, and the expense of the Kilsby Tunnel, on the London and Birmingham Railroad.

The material excavated was a quicksand, and the great difficulty was draining, as the sand becomes fixed when dry. To do this, they attempted horizontal draining, but the drift filling up immediately, they were obliged to resort to pumping, and for this purpose sunk a row of well shafts about four rods (as near as I can recollect) from the line of the tunnel. In some instances, two pumps were worked by one steam engine by long pitmen running in opposite directions, supported on several leading bars. The tunnel when finished has extreme height in clear, 27 feet 4 inches; (?)* span of invert, 22 feet 4 inches; dish of invert 3 feet; (?) extreme width at eight feet above spring line of invert, 24 feet in the clear; above this, the arch has the transverse axis of the semi-oval vertical. The Tunnel near London, through London clay, has full centre, but finding from the nature of the material that something analagous to hydrostatic pressure,

* I am not certain as to the extreme height and dish of invert.

under a height of 60 feet, crushed in the bricks at the crown, they remedied the difficulty by making the arch surmounted, in the subsequent work.

The arches are 18 inches, and invert 14 inches, without bond in the thickness of the arch, but laid in thickness of half bricks, or concentric rings of 4½ inches (a very common arch in England). The side walls are of English bond, and at the intersection of the wall with the invert is placed a freestone skew-back, with face 6 inches in prolongation of face of wall, and beds corresponding with the thickness of the side wall and invert, and normal to their curves; the bottom being level and back plumb. All the rest of the work (except the heads of the Tunnel) is of brick.

Working shafts are found most useful with 9 feet diameter in the clear, walled with two concentric circles of dove-tailed bricks 4½ inches long, making excavation 10·50 in diameter. The wall is put in without curb, and remains where it is first placed, being built upon a wooden ring laid on the bottom. To get down the next length, they support the first piece by four suspenders of two-inch bolt iron, secured in heavy timbers on top and under the ring at bottom. The shaft is then sunk as far as the earth will support itself—another ring put in—the wall built up—(at the same time packing or "punning" in the earth behind it) until it reaches the first piece, when the suspenders are lengthened to support the second ring, and so on to the bottom of the shaft, or top of the arch of the tunnel; where for the time, the wall is supported on a wooden crib until the arch is finished, when a cast-iron curb of 6½ tons weight is masoned into the arch, and the wall built up to the finished wall of the shaft.

In this process, the earth soon binds on the wall, and this leaves but little weight to be sustained by the suspenders.

After reaching the level of the top of the arch, or sufficiently below it to work, they run in a drift, and take out a length on each side of the shaft, and finish it stronger than the rest (except the shaft length which is the same), on arches three bricks, and invert two bricks,=27 and 18 inches thick. The shaft length is then taken out and finished the same thickness as those at the sides, and these three lengths laid in Roman cement. They have then a breast on each side of the working shaft, and when the work is in regular train, the miners and masons work alternately at the two ends, the bankmen above taking up the spoil earth from the miners, letting down bricks and cement for the masons, and timber for the carpenters.

After the first length is finished, and they wish to extend the work, the first process is to drive ahead a drift of four feet wide and five feet high, about four feet beyond the distance they intend to cut down for the next length. The earth in this drift will support itself (otherwise they would have been obliged to make it narrower) until the two beams or "Bars" left above the finished arch at the top of what was formerly a similar drift, can be taken out by means of a log chain attached to the projecting ends, and a jack screw placed against the finished arch. The holes then left by the bars are then filled with earth "punned" in, except near the forward end of the brick work. One end of the bar is then placed in the hole thus left for it, resting on the arch, and the other end supported by a prop raising the forward end a little higher than that on the arch, that it may be drawn out easier when they make the next advance. The roof of this part being thus secured by the two bars (one on each side) kept apart by short straining timbers, the next process is to *widen* the drift on each side as far as they can trust the roof, when another bar is placed in the same

manner as before, having one end supported by the arch, and the other upon a prop, and kept from the former by short straining timbers as in the first case. In widening the drift, about four feet of the forward end is left untouched, and the other part on that which is widened, is also dug deeper (say three feet). After advancing in this manner, placing in the bars systematically on each side, the arched form of the roof will in a short time bring it to the bottom of the excavation, and before advancing farther, it is necessary to get lower. To do this, a bench is left where the props stand, and, having excavated the depth intended, props are placed in front of the first, and reaching to the bottom of the new excavation. The first props are then taken out, the bench cut down, and props of the length of the second put in place of the first. The second set of props are then removed, the breast widened as in the former case, and the vault supported by the bars kept in their places by the united support of the arch at one end, the row of props at the other, and the straining timbers between, until they reach the springing line, and then, if necessary, brace the side of the last bar into the offset by short side props. They have thus an entire temporary wooden arch occupying for the most part the place to be filled with brick, for the roof is but about four inches beyond the extrados to give room for punning the earth behind. To finish the excavation, a bench is left for the foot of the props, and the face cut down plumb, and being supported by planks and posts, the braces, or rather shores, extend in, and are secured upon the finished brick work of the invert. The miners having thus finished their work, and the carpenters secured it from falling, we find at the top of the breast, a short piece of the drift, about four feet long, then a face to the springing line (and up the bars along side of the drift) secured by plank, posts and shores. In front of this, and to the same depth, the props of the side bars, while the props of the two upper bars are towards the back of the drift—these two upper bars being also above the arch range of the others, that they may remain above the brick arch until it is closed. The face of the work in front and below the props likewise secured as above.

The masons having at the same time with this operation completed the arch at the face on the opposite side of the shaft, change sides with the miners, and commence their work by laying the invert, and as they build up the walls and the arch, the earth is rammed in behind at every two courses. Proceeding thus, they come to the spring when the centres are placed upon, but not connected with the brick work below. The cushions are laid longitudinally, and the courses of the bricks the same, and as they come successively to the bars on each side, they are taken out until they reach the two centre bars, when the work is carried on below them until they come to the closing. As they cannot get *above* the arch to do this, the last cushion on each side near the crown has a rabate cut in the edge, into which short cross cushions are placed, beginning at the end of the opening near the finished arch. A short piece of the arch is then closed, the closing bricks being toothed into the finished work, another cross cushion is then put in, and another short piece closed, and thus they proceed until the whole length of the arch is closed. The centres being struck, we find at the top a small hole below the arch through which the miner enters to commence operations for the next length.

Expense. In the sand hills, £22 10s. but ordinary price £16 per yard linear, timber, £2 10s. and carpenters' work £2 10s. per yard, 8,000 bricks and 70 bags of cement per yard, two gangs of four miners, five laborers, two bankmen, two boys and two horses, in a week of seven days,

excavate in best running four yards, and in worst two yards. There are 18 working shafts, and average 30 yards per week of seven days. Four masons and ten laborers, exclusive of bankmen, who are also at work for the miners, will brick a length of eleven feet, in from four to twelve days.

Working shaft 129 feet, much troubled with water, was finished in 7 or 8 weeks, at 50 shillings per yard linear.

Iron bolts, strength 25 tons, connect a plate of cast iron near the head of the tunnel, with another plate 100 feet back.

In the United States we have tunnels driven through earth, but I have no certain information as to their cost. The Grants hill tunnel at Pittsburgh, was not constructed by mining, but by a thorough cut filled up after the arch was turned.

The tunnel on the Union Canal in this state, through a tough black shale, much harder to work than sandstone, ends arched, 18 feet span, 6 feet rise, abutments 8 feet high, face plumb, and excavation taken out roughly to same size, was taken originally at $50 per yard linear, abandoned and re-let at $83 per yard—fair price = $2 50 per cubic yard.

Tunnel on the Alleghany Portage Railroad 901 feet long, width of excavation 24 feet, height 22 full centre, material ¾ slate, ¼ sand stone, was taken at $1 47 per cubic yard, and also received 14 cents for it in embankment—fair price, = $1 61 per cubic yard.

In running drifts, at one of the furnaces in this state, they pay $4 50 per yard linear, for a drift 7 by 7, and also $2 00 per ton for the ore averaging 2 tons per yard, material, iron shale, ball and band ore, rather more difficult to work than sand stone, or $1 54 per cubic yard.

In the Schuylkill coal region they pay $10 00 per yard for tunnels, (so called, when they cross the strata,) through coal and sand stone of every quality from the finest up to coarse pudding stone, $2 50 per yard cubic.

As to works in progress, or but lately completed, I consider the information confidential, but, the above will show the range of prices for mining rock, and have been added in this communication for the information of the general reader, to show the public, that although tunnels are expensive and objectionable when they can be avoided, still, that the expense can be calculated in dollars and cents, and that the range does not differ more than the prices of open work.

Yours respectfully, B. Aycrigg, *Chief Engineer.*

The Little Miami Railroad.

To the Editors of the Railroad Journal and Mechanics' Magazine :—

Gentlemen,—In compliance with a general invitation to your subscribers, I will give a brief description of the Little Miami Railroad ; should you think proper, you can modify it, and give it a place in your Journal.

The Little Miami Railroad Co. was chartered by the Legislature of Ohio, at the session of 1835—6, with power to construct a Railroad from Cincinnati to Springfield, Clark Co.—there to intersect the Mad River and Lake Erie Railroad. For a description of the line and merits of both Roads, see Railroad Journal, Vol. II, Part 2d, pages 640 and 644. The line of the Little Miami Railroad passes through the entire valley of the Little Miami River. A valley unsurpassed, if equalled, for agricultural and manufacturing purposes, by any other of the same extent in the United States. The merits of the work are, to any person acquainted with the great travelling thoroughfares of the West, too obvious to require

comment. Suffice it to say, that this, in connexion with the Mad River and Lake Erie Railroad, unites the Ohio River and all the travelling thoroughfares of the south and the west with Lake Erie and the Ohio Railroad (which is now being constructed) at the north. All of which, together with the New-York and Erie Railroad, form a continuous line of Railroad from Cincinnati to New-York. After the 22 miles, now advertised, have been let, there will be 15 miles of Railroad completed and in operation, and 40 more under contract to be completed the ensuing year, between Cincinnati and Sandusky City. Respectfully, yours,

R. M. Shoemaker.

Second Annual Report of the President and Engineer-in-Chief of the Central Railroad and Banking Company of Georgia, to the Directors and Stockholders. L. O. Reynolds, Chief Engineer.

Engineer Department, Central Rail Road;
Savannah, October 31st, 1838.

To W. W. Gordon, Esq. *President.*

Sir,—Nearly six months have elapsed since the date of my last Report, and as you are about to leave the city to be absent some weeks, I have the honor to present you the semi-annual report of the operations of this department, and the present condition of the work.

The entire route, hence to the city of Macon, although not definitely located, has been so far determined as can be done by experimental surveys. A particular description of the line, as then located to the point where it passes the Ogechee river, was given in the Report of the 10th of May last From that point, it follows the valley of Williamson's Swamp, and crosses this stream near the "Double Bridges;" then taking the southernmost of the two southern prongs, ascends to the summit of the ridge separating the waters of the Ogechee, from those of the Oconee, which ridge it crosses about two miles and a half south of the village of Sandersville.

An examination was made of the valley of Limestone Creek, with a view of making the ascent by that stream; but although we shauld have saved about ¾ of a mile in distance by that route, the line would have been objectionable, both in allignment and grades, which latter would have been undulating, and have frequently reached our maximum rate of inclination, while on the line adoptad, we have a regular and gentle ascent to the summit. Having passed the summit, we avail ourselves of the valley of a prong of the head branches of the Ohoopee for a short distance; this takes us to the head of the Sand Hill Creek, by which we descend to the Oconee river. The line down Sand Hill crosses several deep ravines, and cuts off points of hill, involving a succession of heavy excavations and embankments, rendering this part of the grading more expensive than the general average. The distance of this heavy work however, is only about five miles, and will probably not exceed an average of $20,000 per mile.

We reach the Oconee River near a spot called "Rag-point," about three miles above the mouth of Commissioner's Creek, and sixteen or eighteen miles below Milledgeville. The River Swamp is here about one mile wide on the east, and two miles on the west side—for this distance it will be most safe and economical to support the grade, by strong truss work; and if hereafter it should be deemed expedient to substitute an embankment through the whole or any part of the Swamp,

the road will afford the means of doing it at comparatively a small cost. The River will be crossed by a Bridge 200 feet in length, supported by stone abutments and a pier in the centre.

The line having passed the River, follows the valley of Commissioner's Creek, which affords a very favorable route. The foundation in the Creek Swamp wherever we touch it, is firm. The line may be located with very easy grades and gentle curves, for the distance of twenty-seven miles up this Creek; at this point and thence to the summit, (5 miles) the country is similar to that described on Sand Hill Creek. We pass the summit dividing the waters of the Oconee from those of the Ocmulgee, at a point 8½ miles from the city of Macon, on the Milledgeville road.

Taking a branch of Walnut Creek, we here commence our descent to the Ocmulgee, which is effected by following the valley of this stream.

The ground is so broken and hilly in this region, that our line is confined to the meanderings of the stream, and consequently varies considerably from a direct course, the curvatures however are generally easy—in no case on a radius of less than 2000 feet. From the summit to the Ocmulgee, we again have an expensive section similar to that down Sand Hill Creek—making altogether about 25 miles of what may be termed (in comparison with the portions of our road now graded,) heavy work. This is no more than we have always expected—and when we look abroad and find that the *average* cost per mile of the graduation of most of the roads in the United States, far exceeds that of our most expensive sections, we have reason at least to be satisfied with the natural advantages which the country affords for the prosecution of our enterprize.

The total distance from the City of Savannah to the City of Macon by our line, as above described, is 196 miles. Only 112 miles however being definitely located, there will probably in the remaining portion be some reduction of distance, occasioned by substituting curves for angles, and making slight changes and improvements in the experimental lines.

It was believed by many individuals of respectability, residing in Milledgeville and its vicinity, that our road might cross the Oconee River within a short distance of that place, not only without any material increase of distance, or cost, but with great advantage to the interests of the company as well as benefit to that section of country; and the Board of Directors being desirous that an examination should be made to ascertain whether any advantage would result to the company from such a location, an exploration and instrumental survey was accordingingly made with that object.

The result was an increase of *twelve miles*, and as the point of divergence from the Commissioner's Creek line was above the most favorable portions of that line, and the route thence to the mouth of Camp Creek being through a very unfavorable country for a rail-road, we should, in addition to the increase of distance, exchange twenty miles of very favorable line, for the same distance of very expensive, making nearly the whole distance from Macon to the Oconee, heavy and costly work.

The comparison would stand thus:

By the Commissioners' Creek Line.

From the point of divergence to the Oconee Swamp, 20 miles of grading at $4000	$80 000
Crossing the Oconee Swamp 3 miles, $10,000,	30 000
Bridge over the Oconee River,	20 000
Total,	$130 000

By the Camp Creek line.

From the point of divergence to the mouth of Camp Creek, 20 miles of grading at $25,000	$500 000
Bridge over the Oconee,	20 000
15 miles of grading down the north side of the Oconee, at $4000,	60 000
	$580 000
Difference in cost in favor of the Commissioners' Creek route,	$450 000

To sum up the comparison of the two routes, we have in favor of the Commissioners' Creek line,

1st. An advantage of 12 miles in distance.

2d. A difference of nearly Half a Million Dollars in cost.

3d. An advantage of a gentle and nearly uniform grade down Commissioners' Creek, while on the other line we are obliged to undulate to the extent of our maximum rate of inclination, for nearly the whole distance.

4th. By taking the Camp Creek route, we should violate a provision of our Charter, which requires us to pursue the *shortest practicable route from Savannah to Macon.*

The following extract from the Report of Mr. Randolph Coyle, Assistant Engineer in the service of this Company, who made the surveys, more particularly describes the character of the country and the route surveyed.

"The survey of the route to pass in the vicinity of Millegeville, (via Camp Creek, &c.) was commenced at that point upon our Commissioners' Creek line, where it is crossed by the Millegeville and Marion road. Going thence towards Millegeville, we cross first, the ridge separating the north and south branches of Commissioners' Creek. The crest of this ridge is uneven. The entire country between the north and south branches of Commissioners' Creek, is broken by numerous deep vallies of small streams. The Marion road passes this ridge at about the most advantageous point. On the west of the road, the ridge rises rapidly, and becomes broken; on the east of it also the ridge is high and broken, to the very junction of the two branches of Commissioners' Creek. Our survey was conducted, as far as the north branch of Commissioners' along this road, a cross line being run upon the crest of the ridge, for some distance on each side of the road, to ascertain whether or not a more favorable passage through the ridge existed.

"Arrived at the north branch of Commissioners', it became necessary to ascend from its valley to the head of Camp Creek. The country affords no stream whose valley will conduct us to this point, except Beaver Creek. The sources of Beaver Creek interlock with those of Camp Creek and Black Creek; it empties into the north branch of Commissioners, about $2\frac{1}{4}$ miles below where our line first attains the valley of that stream. Our line descends the valley of the north branch, to the mouth of Beaver Creek, and ascends the valley of this latter stream.

"As Beaver Creek enters the north branch very obliquely, we were desirous, if possible, to establish our line directly across the ridge dividing them, and, to ascertain the practicability of this, traced a compass and level line along the crest of that portion of the ridge which could come within the range of our operations. The result showed us that the ridge was impassable, except at an expense of high grades and deep cutting, more than equivalent to the increased distance by the valley line.

"Beaver Creek has an eastern and a western branch, the vallies of both of which were occupied by our lines. The western branch heads within one fourth of a mile of the head of Camp Creek. The summit to which it conducts, is narrow but very high. The eastern branch, conducts not immediately to the head of Camp Creek but to the head of Black Creek, a stream which empties into the Oconee, about half way between Camp and Commissioners' Creek. The ridge between the heads of the western branch and Camp Creek, is, however, 60 feet higher than that between the eastern branch and Black Creek, or that between Black and Camp Creeks. The distance is very nearly the same by both branches to the head of Camp Creek. From the head of the eastern branch of Beaver Creek, the line crosses to the eastern slope of the dividing ridge between the Oconee and Commissioners' Creek, and runs northward about 1½ miles to the head of Camp Creek. For the greater part of this distance of 1½ miles, the line occupies the vallies of two small streams, heads of Black Creek, which run, the one in a northward, and the others in a southward direction; the first having its source very near that of the eastern branch of Beaver Creek, and the second rising near the heads of Camp Creek and the western branch of Beaver. Crossing from the head of Black Creek to the head of Camp Creek, the line pursues the valley of this last stream, along its northern bank, to its mouth, about one hundred yards above which it crosses the Oconee. Thence it descends the Oconee to within 1½ miles of the point of high ground, dividing its valley from that of Buffalo Creek. There is here a very low pass through this ridge, which the line occupies, and connects with an experimental line run by yourself in the valley of Buffalo Creek, near the road leading to the Buffalo lower Bridge.

"The average fall of the valley of Camp Creek, would give a tolerable high grade, could one uniform grade be established from its source to its mouth. Its fall is, however, very unequally distributed throughout its course, being, near its head, extremely rapid, and comparatively gentle as it approaches the Oconee. A line even tolerably cheap near the head of this stream, would require far steeper grades than 30 feet per mile. It would be possible, by cutting from 40 to 50 feet at the head of the stream to descend it with a grade of 30 feet per mile, which would eventually bring the line down to the bottom of the valley; but such a line would, of course, involve the necessity of very high embankments across the vallies tributary to Camp Creek, and of very deep cuts through the ridges separating those vallies. When it is remembered that the very great elevation of the short summit, (that at the head of the western branch of Beaver Creek,) compelled us to adopt for our ascending line the eastern branch of that stream, and to attain the head of Camp Creek by means of the vallies of small heads of Black Creek, it will be perceived that the necessary cut at the head of Camp Creek must be as long very nearly, as the whole summit section—one mile and a half. There is a small portion of this section where a line could find, in the vallies of the Black Creek branches, ground low enough to avoid heavy cutting.

"The general character of the country between Commissioners' Creek and the Oconee, with the exception of a part of the valley of Camp Creek, is similar to that of the summit section of our Walnut and Commissioners' line. The surface soil is light sand, beneath which is stiff, hard clay. This would probably be the only material to be encountered in the cuts through the ridges between the north and south branches of Commissioners' Creek, between the heads of Beaver and Black Creeks, and between the heads of Black and Camp Creeks. About six miles below the head of Camp creek, that stream enters the Mica Slate. From this point to the Oconee, we should probably have to blast the rock in every excavation. The expense of blasting is not the only evil we would have to encounter in consequence of this rock. Its effect upon the character of the valley is, from obvious causes, very unfavorable to us. It renders the stream crooked. Little or no alluvial flat occurs along the stream below where it enters the rock, but the hills, alternately gentle and abrupt on opposite sides, slope down to the channel. From these causes the most favorable part of the line in this portion of the valley must be— the allignment, a series of reversed curves—the graduation, a succession of cuts through the points of the hills where they advance into the bends of the stream, and embankments across the heads of the basins little which are formed between those points of hills. These cuts and embankments will be less in proportion, as the radii of the curves are reduced. The unfavorable line in this portion of the valley, will be at those points where the rocky hill side makes a steep bluff to the stream.

"The site at the mouth of Camp Creek is most favorable for a viaduct. The average depth of the river at its lowest stage is here about 8 feet. The bottom is of solid rock. The banks are high. There is no swamp.

"From the crossing of the Oconee to Buffalo valley, the line is as favorable as could be desired, with the exception of one point, which is where Town Creek empties into the Oconee. These streams here form a large swamp which runs up into the country, like a bay, for a considerble distance. To cross it would require an embankment averaging 5½ feet high for 1½ miles.

"That there might be not the least doubt concerning our ability or inability to cross from the valley of Camp Creek to that of Fishing Creek, at Milledgeville, a line was run, to obtain the profile of the ridge separating those streams. The result showed that its elevation at the lowest point was 125 feet above Camp Creek valley, where it was proposed that we should leave that valley. The average distance between Fishing and Camp Creeks for three miles above the mouth of the latter, and two miles above the mouth of the former, does not exceed two and a half miles. Any cut through the ridge must be mostly through solid rock.

"I am satisfied that every attempt to cross the ridge between the two branches of Commissioners' Creek, or that between that Creek and the Oconee at points farther north than our experimental line, would succeed only in encountering a much higher and more broken country."

It may be proper here to mention, that the country on the East side of the Oconee affords a most favorable route for the construction of a Rail Road from Milledgeville to our line. The grade would be almost one uniform inclination, and the low lands bordering on the Oconee Swamp would require but little excavation and embankment to form the road bed.

The grading of our road is now under contract to a point 112 miles from the Depot in this city, and the contractors are bound to complete it to that point by the first of March next.

The timber for the superstructure is laid for the distance of 55 miles, and progressing at the rate of five miles per month.

The iron is laid and the road completed 46 miles. Our Engines now run daily with the Macon Mail and Passengers to that point.

The bridge over the Little Ogechee is finished, and the grading, including most of the bridges and culverts, done for a distance of 79 miles.

The force now employed on the line is about 500 men, and the contractors are daily augmenting their forces, so that we shall probably in a short time have three times the present number.

It is worthy of remark, that there has not been a contract relinquished or abandoned, since the commencement of the work.

We have commenced the erection of the machine shops at the Depot in this city, which are to be of brick, and on a scale suited to the magnitude of the enterprize.

A further distance of fifteen miles of grading is advertised for letting on the 1st of December, which will extend our work 127 miles from this city.

I have often been asked the question, "why do not the Company commence work on the upper end of the line?" Such a desire no doubt exists with many persons deeply interested in the success of the undertaking, residing in that part of the country; but it is presumed they are not aware of the difficulties attending such a course.

If our operations, which are at present widely extended, were so far enlarged as to embrace any portion of the farther extremity of the road, a separate establishment and organization of supervision and superintendance would be unavoidable. The Engineer Corps would require to be increased, and whatever work might be done, would not only be unproductive of profit to the Company, but the excavations and embankments being exposed to the weather, would by washing, deteriorate 8 or 10 per cent before they could be brought into use. It will not for a moment be supposed that it would be expedient to haul the iron for the tracks in wagons, or even ship it *via* Darien for Macon; such a course would add greatly to the cost without any equivalent benefit. By our present arrangement, the iron and other materials, as also most of the supplies to contractors are carried forward by our Locomotive Engines, and the freight and passage money collected, not only defrays the expense of this transportation, but already nearly pays the expense of our mechanical establishment at the Depot in this city.

The advantages of keeping up a communication from this end of the line as we advance with the work, and of finishing the work continuously, I am persuaded will strike any one who will take the trouble of reflecting on the subject.

I had intended to present you an estimate of the cost of the whole road in this Report, but the time since the completion of the explorations and surveys determining the western end of the line has been so short, that the necessary computations for a careful estimate could not be made. These surveys, however, have not developed any facts leading me to believe that the work will cost more than the original estimate made by Col. Cruger, which you will recollect was a little over Two Millions of Dollars.

For a view of the whole route herein described, I refer you to a map which I now hand you, on which it is laid down in a red line, with the topography of the adjacent country, on a scale of 200,000 feet to one foot, or about three miles to one inch.

The surveys detailed in the Report, of the line passing near Milledgeville, are also laid down in a blue line on the same map.

Iam, Sir, very respectfully, your obedient servant,

L. O. REYNOLDS, *Chief Engineer,*

(From the Journal of the Franklin Institute.)

Protection of Iron by Zinc.

The invaluable discovery by Mr. Sorel, of an effectual and cheap method of preserving iron from rust, or corrosion, by zinc, described in a recent number, has occasioned the formation of a Galvanized metal company for the manufacture of zinced Iron, and the extension of its use throughout Great Britain. The happy solution of this long sought chemical problem, which will doubtless be productive of immense economy in the use of a metal. the demand for which must continually increase faster than the possibility of its adequate production, must hereafter constitute, like the steam engine, one of "the most valuable presents from philosophy to the arts." The following testimonials to the soundness of the principle and value of the discovery, are from the prospectus of the English, Scotch, and Irish Galvanized-metal company. G.

M. Sorel, a French chemist, after many years of study and experiment, discovered an application of a scientific principle of preventing the oxydation or destruction of metals. particularly iron, as effectual as it is simple and inexpensive. His discovery is protected by a patent in France, where, for some months, the process has been in successful operation. Patents have also been granted for the invention in the United Kingdom.

The discovery has been submitted to the consideration of the following eminent British chemists:—W. T. Brande, F. R. S., Professor of Chemistry to the Royal Institution; J. G. Children, F. R. S.; Thomas Graham, Professor, London University; A. Garden, M. R. I.; Richard Phillips, F. R. S.; and such of the Reports of those gentlemen as have been received are annexed.

By Professor Graham of the London University.

The effect of zinc in protecting iron from oxydation has been known to chemists for some time. When these two metals are in contact, an electrical or galvanic relation is established between them, by which the iron ceases to be susceptible of corrosion by dilute acids, saline solutions, or atmospheric humidity. It was found in experiments lately conducted at Dublin and Liverpool, that small pieces of zinc attached to each link of a chain cable were adequate to defend it from corrosion in sea water. The protection was observed to be complete, even in the upper portion of the iron chains by which buoys are moored, and which from being alternately exposed to sea water and air is particularly liable to oxydation, so long as the zinc remained in contact with the iron links. The protecting influence of the zinc could not be more certainly secured than in the articles prepared by the patent process, the iron surface being uniformly coated over by that metal. In trials, to which I have had an opportunity of subjecting them, the iron escaped untouched in acid liquids, so long as a particle of the zinc covering remained undissolved. The same protection is afforded to iron in the open atmosphere by zinc, with a loss of its own substance, which is inappreciably minute. The zinc covering has the advantage over tinning, that although it may be worn off and the iron below it partially exposed, the iron is still secured from oxydation by the galvanic action, while the smallest quantity of zinc remains upon it; whereas tin in common tin plate, affords no protection of this kind, and not being absolutely impermeable to air and moisture, the iron under it soon begins to rust in a damp atmosphere. The simplicity and perfect efficacy of the means employed to defend iron from the wasting influence

of air and humidity in this process of zinc-tinning, certainly entitle it to be ranked as one of the most valuable economical discoveries of the present age.

THOMAS GRAHAM,
Professor of Chemistry.

University College, London, April 17th, 1838.

Jointly by J. G. Children, Esq., F. R. S., &c., and A. Garden, Esq., M. R. I. &c.

The so-called galvanized iron consists of iron coated by zinc. The process by which the union of these two metals is effected we are ignorant of, as we have not seen a copy of the French patent, but we conclude that it is somewhat similar to that by which iron is coated with tin, since, that zinc may be so employed instead of the latter metal was pointed out by the Messrs. Aikin in their Dictionary of Chemistry, as long ago as the year 1807. The method adopted by Sir H. Davy, for protecting the copper sheathing of ships by means of some metal whose electrical relations are positive with respect to the copper, may have suggested the idea of a similar protection to iron, and it is obvious to theory, and demonstrated by fact, that zinc is an incomparably more powerful agent in producing that effect than tin. A material difference, however, exists between the French invention and that of Sir H. Davy, since the English philosopher employed *contact* of the metals only in protecting copper; whereas Monsieur Sorel avails himself of the chemical (or electrial) affinity of the metals in the most extensive and perfect contact in protecting iron.

Certain specimens have been shown to us as the results of comparative experiments made by exposing articles formed of galvanized iron, and similar articles of tinned iron, and of iron in an uncovered state, for several months, to the influence of the atmosphere, in which the iron of the first remains unaffected, whilst that of the two latter is very much oxydated. Time has not been allowed us to repeat this, the most simple and most conclusive experiment; but, those which we have been enabled to make in the short interval that has elapsed since our opinion on the merits of this invention has been demanded, give us every reason to believe that the results alluded to have been honestly obtained, and that they afford decisive evidence of the efficacy and importance of this method of protecting iron from rusting influences.

The experiments we have made consisted in exposing plates of galvanized iron, and similar plates of tinned iron, and of iron altogether unprotected, in separate vessels, to the action of distilled water, a solution of common salt of about the same strength as sea-water, and of diluted muriatic acid. In every case, the unprotected iron and the tinned iron were acted on and oxydated in a very few hours, and in three days abundance of red oxyde of iron was found to have been deposited in each vessel containing the iron plates and the tinned iron plates; but in those containing galvanized iron not the slightest trace of red oxyde could be detected, and, except an almost imperceptible discoloration of the zinc surface, which in one or two instances had become a little darker, the galvanized iron was entirely unchanged. A piece of galvanized iron plate and of simple iron plate were also placed *in contact with each other* in distilled water, and another similar pair in a solution of common salt. In three days neither plate showed any symptoms of the iron having been oxydated, so that the protecting power of the zinc of the galvanized iron plate appears to have extended to the iron plate in external contact with it also. It had been

suggested to us that perhaps accidental or partial abrasion of the zinc surface might occasion the iron to rust into holes where unprotected. We did not think this likely, nevertheless, we put it to the test of experiment, and with a file cut lines into the galvanized plate entirely through the zinc, so as to leave the surface of the iron exposed, and did the same with a plate of tinned iron. In every instance the lines in the latter were filled in a day or two with red oxyde of iron, while those in the galvanized iron plate retained their undiminished metallic brightness. We did more,—we dissolved off every particle of zinc from two portions of the galvanized plate—in one case by very dilute muriatic acid, in the other by equally dilute sulphuric acid As soon as the whole of the zinc was removed, the solution was poured off, and a portion of it, to which some nitric acid was previously added, was tested for iron by pure ammonia; when the only evidence that any portion of the latter metal had been dissolved, was a very faint reddish tinge which prevailed through the liquid, but so slight as hardly to afford a sensible precipitate of light floculent particles, after considerable repose. With the evidence of these facts before us, we can have no hesitation in stating our opinion that this method of protecting iron from rust will prove of infinite service in a variety of arts, and will admit of economical application in numerous ways, as the roofing of buildings, sheathing and bolting of ships, and a thousand other forms, and entirely supersede the employment of tinned iron, except in vessels used for culinary purposes, in which, we fear, it could not safely be adopted. It is possible that the objection to the use of H. Davy's protecting copper for the sheathing of ships, may also prevail against the employment of the galvanized iron for the same purpose,—the increased tendency to foulness from the adherence of barnacles, weeds, &c., to the ship's bottom; at the same time we think it probable that it may not be liable to that drawback; but this question must be referred to the only satisfactory solution—*experiment.*

J. G. Children,
A. Garden.

London, 17th April, 1838.

By William Thomas Brande, Esq., F. R. S.

Royal Mint, 26th April, 1838.

Gentlemen—I have examined the several articles sent to me by your order, under the name of *galvanized iron*, and represented as manufactured of iron in various combinations with zinc. In this way an arrangement susceptible of electric excitation is obtained, in which consistently with the laws of electro-chemical action, a preservative power is conferred by the zinc upon the other metal; for in all cases in which two different metals are in contact, a current of electricity may be established in them in such a direction as to protect the least oxydizable of the two metals.

In common tin-plate, or tinned iron, the combination is such that the oxydizement, or corrosion of the iron, is accelerated by the tin, so that *iron* is the *protecting* and the *tin* the *protected* metal; but in the case before us, in which the respective metals are iron and zinc, the reverse effect ensues, the *iron* is here the *protected* metal, and *zinc* the *protector*; and, consequently, when these latter combinations are subjected to the action of water and other agents, the iron is preserved from corrosion so long as any zinc remains to maintain the electrical current.

I have subjected pieces of this prepared iron to the action of distilled water, to rain water, to sea water, to the joint action of air and water, to

dilute solutions of sulphuric, nitric, and muriatic acids, and to other oxydizing or corroding agents upon the common tin plate and upon wrought and cast iron, and, as was expected, the rusting and corrosion of the iron, is in all these cases entirely prevented in the zinced, or patent plate; whereas, on the other hand, it goes on with more or less rapidity in regard to the unprotected, and the tinned iron; and, as respects the latter, the iron, whenever it is exposed, appears to be more rapidly corroded in consequence of the adjacent tin.

As far, therefore, as under these circumstances the relative durability of the patent iron as compared with either wrought, or cast iron, or with tinned iron, is concerned, permanence is excessively in favor of the former; and there can be no doubt of the great advantage that must accrue in a vast number of the ordinary applications and uses of these substances, in the employment of the zinced, or patent plate, and in its substitution for any of the usual forms of manufactured iron.

As my experiments have necessarily been limited in regard to time, I cannot speak with certainty as to effects which may possibly ensue from the protracted action of chemical agents upon the zinced iron; but both theory and experience lead me to believe that so long as the zinc endures, the protection will hold good.

Again, speaking theoretically, I should presume that the zinced plate, or the other forms of the protected iron, would be admirably adapted for roofing materials, gutters, water pipes, chimney tops, packing cases, and all analogous applications in which a light and durable material that will resist the joint action of air and water is required; that it would also be well adapted for certain tanks and cisterns; for the manufacture of a great variety of articles required to endure a damp atmosphere, such as locks, keys, hinges, &c.; for cellars, warehouses, and all exposed situations; and for the iron-work of bridges, canal locks, and of much other machinery; for the beams and columns of buildings; for clamps, bars, rails, bolts, nails, screws and nuts; for all out-door works; and for many implements in, and parts of chemical and other manufactories. In short these applications are as obvious as they are endless.

On the whole, I regard this as by far the most valuable practical application of the electro-chemical principle of the protection of metals which has hitherto been carried into effect.

I am, gentlemen,
Your faithful servant,
WILLIAM THOMAS BRANDE.

In addition to which indubitable opinions, the following translated extracts from the French Society are corroborative and interesting.

"Chemists have long attempted to apply electricity by perpetual contact to the preservation of iron; but the means employed were defective and unsuccessful, until the recent discovery by M. Sorel. Sir H. Davy died with the conviction, that the application of the principle was possible, and would some day be attained.

"Science has already given testimony in favor of M. Sorel's process. Messrs. Dulong and Dumas have frequently alluded to it in their addresses to L'Academie des Sciences.

"The following extract is from a Report made to the General Meeting of La Société d'Encouragement, at which Baron Thenard presided on the 5th July, 1837.

"'The experiments of several members of the Committee of the Chemical Arts have proved that M. Sorel's process effectually protects iron from oxydation. It is, therefore, to be expected, that the galvanic coating will soon be applied not only to the sheet iron but to many of the larger masses of that metal, cast or wrought, which are employed in naval architecture, military implements, and domestic buildings, especially to the iron-work of shipping exposed to the atmosphere, or to salt water; to war projectiles, to masses of iron buried in damp situations, or covered with plaster.

"'The Galvanic Paint is well adapted to all articles of iron exposed to the action of the air or water, or both alternately.'"

Extract from the Report of L'Academie des Sciences.

Paris, 11th April, 1837.

"M. Dumas read a Report, by which it appeared that various trials had been made by Sir H. Davy and other chemists to preserve iron from rust, but that none had succeeded. He at the same time read a letter from Captain Born, (of the Artillery of France,) addressed to the Academy, calling their attention to the vast importance of this discovery in its applicability to military purposes only. In giving the substance of Captain Born's letter, M. Dumas said, 'the military and naval artillery had a stock of 7,784,000 projectiles of the value of 26,000,000 francs (1,100,000*l.* sterling.) According to Captain Born's estimate, a pile of cannon balls, after twenty years' exposure to the open air, are almost all unfit for service. If it be admitted, as it must be, that the value of a projectile, sold as cast iron, is not more than one-third of its cost price, then is the importance of this discovery apparent. Supposing that the government of France should adopt M. Sorel's process, the expense of which is very trifling, it then would appear, from Captain Born's calculations, that a saving of 17,333,334 francs, for this part alone of the war department, would accrue in twenty years.'"

The Patent Process may be applied in three different ways, all equally simple:—

1. By coating iron with zinc in a fluid state.
2. By applying a paint made from zinc.
3. By covering with a powder made from zinc.

Under the first process, many articles, not already referred to, will occur to every one considering the subject. Gas-pipes, water-pipes, rails, for tram-roads, iron-bridges, iron boats, roof-gutters, iron-railing, interior of steam-engine boilers, iron sheathing of ships, ship's bolts, &c. On the applicability of the patent process to the three last mentioned articles but little, if any, doubt exists in the minds of our most eminent chemists. The difference in the cost of a seventy-four gun ship between iron and copper would be as 810*l.* to 6480*l.* The saving in her Majesty's Navy and in the Mercantile marine of this country would consequently be enormous.

Under the second process, zinc paint would be employed wherever the bulk of the article to be protected or the difficulty of displacing it would render an immersion of iron into the heated metal impracticable. Bridges, therefore, already constructed, boats already built, in short, all articles already fixed may be preserved from further decay by the use of the patent paint. This paint will not be dearer than white lead.

By means of the third process, the finer sorts of iron and steel will be preserved. All articles of hardware and cutlery are subject to the most serious deterioration by exposure to moisture; but, by applying to them

the Galvanic powder, or wrapping them in paper prepared with it, they may be exposed with safety to any weather, or exported with security to any climate.

It remains only to repeat that the processes are not expensive. However numerous and important are the admitted advantages of these discoveries, they would be less striking were they to be obtained only at a high price. The process of coating with the metal in a liquid state is cheaper than tinning. Tin is worth 98s. per cwt., zinc 20s. per cwt. Supposing that galvanized sheet iron should be sold at the price of tin plate, the profit would be, at least 100 per cent.—*London Mech. Mag.*

Signor Pistrucci's new method of striking up Medals without the aid of engraving. By Wm. Baddeley.

Signor Pistrucci's first application of his new process, has been in striking up a seal for the Duchy of Lancaster. This seal is four inches in diameter, of sterling silver; one side presents a very beautiful equestrian figure of her Majesty Queen Victoria, surrounded by a bold inscription; on the reverse, the arms of the Duchy are richly emblazoned, in the midst of a profusion of scroll-work, with an inscription. To have *engraved* the two dies for striking up this seal, would have taken about fourteen or fifteen months hard labor, with the risk at the end of that time, of the dies breaking in the process of hardening. By Signor Pistrucci's method, they have been produced in less than fifteen days.

There is an exquisite softness, and a boldness of relief, in many parts of this seal not attainable in an *engraved* die; the graceful flowing of the drapery, the prominence of the arm of her Majesty, as well as the ear and hoofs of the horse, are altogether unrivalled. The fame of Signor Pistrucci's success has drawn to the Mint, most of those who are celebrated for their practical acquaintance with the powers and properties of the metals, and with mechanics generally; one and all of whom have expressed themselves astounded at the results obtained. When such gentlemen as Bramah, Maudslay and others, state, that nothing short of seeing with their own eyes would have satisfied them of the possibility of such a work, incredulity may well be pardoned in those who have not witnessed the recent production. There are plenty of workmen in the Royal Mint, well versed in all the methods employed at the *Soho* for the last fifty years, and they all agreed in designating Mr. Pistrucci's plan, when first propounded to them,—as a *new fangled and impossible scheme*, and yet have these very workmen themselves since proved its *possibility*.

The outline of Signor Pistrucci's plan, is tolerably well explained in the *Times* newspaper; the subject is modeled in the usual way, either in wax, clay, or other fit material, from which a cast is taken in plaster of Paris. The plaster cast being hardened, is moulded in fine sand with great care, and a cast, in iron, is taken from it. The great *secret*—if there can be any secret in what has been published in the leading journal of the day, and thence very extensively copied into other publications—consists in the *thinness* of the *iron castings*. The plaster of Paris model is left only about one eighth of an inch thick, the consequence of which is, that the *chill* which takes place on the *surface* of all iron castings, from the proximity of the two surfaces in this instance, pervades the whole mass, giving it the hardness of a hardened steel die, with a toughness, not attainable by the latter metal while in a hard state.

In all large castings, the contraction of the mass of metal in cooling causes a shrinking of all the finer lines, while in thin casting, the sharpness of every line is preserved with surprising beauty.

The iron casting having been made perfectly flat at the back, a hollow is turned out in a steel bed to receive it, and when thus mounted it is ready for use. One proof among many others, of the extreme hardness of the cast iron dies, is afforded by the fact that no extension of the metal takes place from the severest blows: the die fitting no tighter into its bed after striking up a medal, than it did before. The seal before alluded to, took upwards of one hundred and fifty blows from the most powerful press in the mint, and the dies appear in every respect as perfect now as when first cast.

Many persons, who, from their known celebrity and eminence in the scientific world, would be considered the very highest authorities that could be cited in a question of this kind, have not only on examination admitted the *entire novelty* and great importance of this process, but have charged Signor Pistrucci with injustice to himself, for neglecting to secure the privileges of a patent. This, however, the Signor has from the first declined to do; choosing rather to throw open the result of his (miscalled) "hours of idleness," for universal public benefit.

What the real value of this discovery is—or where the useful application of the fact thus established will stop, it is at present wholly impossible to imagine. The advantages of being able to produce at so little cost, and in so short a space of time, the most perfect and beautiful designs—or to copy with so much facility the choicest productions of others, are altogether incalculable. One drawback, perhaps, is the power thus placed in the hands of the fraudulent copyist, and the spurious coiner; but the knowledge of an existing power to do certain mischiefs generally produces an antidote sufficient for the evil, and it is to be hoped the present case forms no exception to the rule. One happy effect of the general introduction of this method of obtaining *dies*, will be to make the *die-sinkers* more of *artists* and less of *mechanics*, to wield the graver *less*—but the pencil *more skilfully*. Should my endeavors to render this useful process intelligible, not be sufficiently explicit, I shall have much pleasure in affording any additional information that may be thought necessary.—*London Mech. Mag.*

Abstract of Papers Read at the Institution of Civil Engineers.

(Continued from page 292.)

"On the Evaporation of Water from Steam Boilers; by Josiah Parkes."

This paper contains the result of various experiments, conducted with the view of ascertaining the quantity of water which can be evaporated under particular circumstances by a given quantity of fuel. The results are tabulated with great accuracy, and all the authenticated data known to exist on this subject are brought together in a form in which they may be generally useful.

The author was induced to make sundry experiments on the supply of fuel and of air to the furnaces of the engine, with the desire to consume or diminish as much as possible the smoke and soot emitted from the chimney.

The furnaces had hopper mouth-pieces, with a provision for admitting

a thin stream of air over the mouth-pieces into the fire, in order to consume the smoke; but which was of very little service, as volumes of smoke rolled forth from the chimney at each successive firing. Heavier and less frequent firing was adopted, and at the same time a careful admission of air over the hopper into the fire; but still the nuisance remained undiminished.

From the researches of Sir Humphry Davy on the safety lamp and on flame, it occurred to Mr. Parkes that the air must be given directly to the uninflamed gas at the point of greatest heat, the temperature of incandescence being necessary for inflammation; whereas, formerly, the air had become vitiated by passing over inflamed fuel, and that the bridge of the furnace was the most fit place for the supply of air, as it would there encounter all the inflamed and uninflamed gas, and obtain at all times the temperature necessary for ignition. Previously to the necessary alterations of the furnaces, the duty done by the coals, as ascertained by the evaporation of water, was carefully registered.

In respect to the firing of furnaces, the author had observed that somewhat less smoke was emitted from less frequent than from very frequent firing, and that somewhat more water was evaporated by the same weight of fuel in the former than in the latter case. Also, that in consequence of less poking, fewer cinders were made; the dampers were lower, as there was a greater mass, though less intensity of heat; and the temperature of combustion being less elevated, there were fewer scoriæ. The operations of firing were gradually diminished, until a mode of working the engine with two charges of coal per diem was arrived at, the furnaces being loaded in the morning as rapidly as keeping up the steam would permit, with sufficient coal to work the engine till dinner-time. The grates were then cleaned, and charged again during the dinner-hour, requiring no more coal during the day. The results attending these alterations were most important, viz., economy of fuel, steadiness of steam, much less smoke, still fewer scoriæ. On the re-construction of the furnaces necessary for the admission of air at the bridges, the whole capacity of the furnaces were enlarged, that they mght contain at once the entire of the fuel requisite for the day's consumption. At the same time the boilers were covered with double arches of brickwork, leaving an air space between each arch and the boiler, coating the outer arch thickly with strong hair mortar, mixed with waste of wool. Eye-pieces were also made in the walls at the end of the boilers, opposite the fire doors, to obtain a view of what might take place at the bridges on opening or shutting the valves; also eye-holes for the side flues, to ascertain how far the flame extended. The results were now of the most satisfactory nature, no smoke being visible from about seven in the morning. The dampers were very close down, and capable of keeping the steam so steady, that it did not vary one-eighth of an inch in height for many hours. The furnaces, when charged, may be considered as great reservoirs of fuel, in a constant, equable, but moderate state of combustion, not the entire mass on fire at once, but distilling first its gaseous products, and then gradually entering into combustion.

The greatest evaporation which was obtained from 112 pounds of coal was 18·5 cubic feet, supposing the water to have entered the boiler at 212 degrees. This was accomplished with both Netherton and Newcastle coal, the Wednesbury giving something less; whilst, before the introduction of the above-mentioned advancement, twelve cubic feet was the greatest evaporation.

This method, which had been followed so successfully, was subsequently made the subject of a patent, and applied to above 500 furnaces; but has gradually fallen into disuse, from its not being worth the master's care and time to see that the firemen do their duty. The author details a conversation which he had with Sir Humphry Davy, who had been making experiments on the temperature at the bridge, and the gaseous products of combustion; during which, that distinguished philosopher gave it as his opinion that the plan could never be established in general practice; that it was too simple, and depended on the fireman and not on the master, who will not concern himself with saving a few coals; that the same was his safety lamp; one-half of the miners will not use it, but persist in working comparatively without light, and in danger of explosion, rather than adopt a simple contrivance which requires a small amount of trouble and care.

The paper is accompanied by four tables, the first of which contains the experiments made by himself; the second, the results of the Cornish boilers, from Captain Lean's report; the third, those of locomotive boilers, from De Pambour's work; and the fourth is a comparative table of the mean, greatest, and least results of the experiments on the three classes of boilers. The temperature of the water being different in the various experiments, a common standard is introduced by calculation, and the numbers express the quantity of water of 212° Eahrenheit, which would be evaporated by a given weight of coal.

	Cubic Feet
The mean value of 112 lbs. of coal in evaporating water of 212° Fahrenheit is in the Cornish boiler . . .	21·16
Mr. Parkes' Experiments at Warwick . . .	18·5
——————— in Lancashire . . .	13·49
Ordinary boilers, and system of firing. . . .	14
Locomotion	10

Thus the efficiency of boiler being measured by the quantity of water evaporated by a given quantity of fuel, it appears that the boiler of the locomotives, is far the lowest in the scale, and the Cornish engines the highest. The paper concludes with a review of the state of our knowledge on the application of heat, and on the value of different kinds of fuel.

"The Land Surveyor's Calculator; by George Heald."

The instrument to which the above name is assigned, was invented for the purpose of avoiding the necessity of performing long arithmetical calculations in surveying estates, the results being given at once by the adaptation and inspection of the instrument, as directed. It may also be applied to extracting the square roots of numbers, and the other purposes to which Gunter's scale is applicable.

The instrument consists of five concentric circles, whereof the four inner ones are on the outer edge of a card, moveable about a centre, and the fifth or outer circle is fixed.

The circumference of the fixed circle is divided into 1,000 logarithmic portions, representing links, and numbered 10, 11, 12, at every ten divisions, which numbers represent 1 chain; 1 chain, 10 links; 1 chain, 20 links, &c. From 1 chain to 1·5 chains these divisions are each subdivided into five parts, which serve to indicate the proportional parts of a link.

The next circle, formed by the graduated edge of the moveable piece

of card-board, is in all respects similar to the first, save that the divisions are carried round in the opposite direction. The second circle on the moveable card-board represents areas and decimals, commencing with half an acre, and proceeding up to five acres.

The next circle divided into perches, to correspond with the preceding decimal division. It is numbered at every ten perches, and the acre is expressed at the termination of every rood.

The last, or fifth circle, is to show the area in acres, roods, and perches; when it is under two roods, it is numbered accordingly.

The author then describes the method of using the instrument for the solution of questions similar to the following. Having the diagonal and the two perpendiculars of a quadrilateral, or the base and perpendicular of a triangle; to determine the areas of the respective figures. The result is known at once in acres, roods, and perches, on inspecting either the fourth or fifth circle, according as above the area is greater or less than half an acre.

The instrument may also be used to the computing square yards, to the extracting square roots of numbers, and the ordinary operations of multiplication and division in the same manner as on other logarithmic lines.

A great advantage of this instrument results from the graduation being on the circumference of a circle. Great enlargement of the divisions is thus obtained, and in a far more convenient manner than by drawing a slide as on the common sliding rule. The diameter of the outer circle in this instrument is sixteen inches; and to obtain divisions of the same magnitude, a rule with its slide drawn must be eight feet four inches. The author considers that a circle of eight inches diameter would be sufficiently accurate for practical purposes, and would render the instrument extremely compact and portable.

Mr. Mushet presented some specimens of malleable iron, in his opinion peculiarly adapted for railway purposes. The feature peculiar to this iron is, the omission of the refining process in its manufacture. The valuable properties of malleable iron being fibre and hardness, Mr. Mushet considers that these are but imperfectly secured by the present process. Iron, as at present generally manufactered, receives the fibre from repeated heatings and rollings; but fibre thus acquired, is obtained at the sacrifice of hardness. The fibre of malleable iron may be injured by overheating, by adding in the smelting furnaces ores rendering the iron cold, short; or by the use of cinders, which, when in excess, cause the fibre to crystallize and produce brittleness. Some irons, however, are so exceedingly fibrous, that they admit of a limited quantity of cinders without deterioration. By omitting the refining process, a greater mass of fibre can be produced than in any other manner; and this fibre, in consequence of the iron not being exposed to so severe a degree of decarbonization, is stiffer and harder than that acquired by repeated heatings and rollings. The iron used for railways should be from grey mine pig-iron, as the source from which the hardest and strongest fibre in malleable iron is derived. The use of cinder-pig should be excluded, on the ground that the quantity and quality of the fibre is injured; and if in the state of grey iron, its fusibility is so much increased, as to occasion great waste in the puddling and subsequent re-heatings.

"Paper on the Canal Lifts of the Grand Western Canal, by James Green."

These lifts are not intended to supersede the use of locks in all cases, but in those in which a considerable ascent is to be overcome in a short distance, and in which the water is inadequate to the consumption of a common lock, or in which the funds are inadequate to the execution of the work on a scale adapted to such locks. These lifts are forty-six feet in height, consisting of two chambers, with a pier of masonry between them, similar to those of a common lock, and being of sufficient dimensions to admit a wooden cradle in each, in which the boat about to ascend or descend floats. The cradle being on a level with the pond of the canal, a water-tight gate at the end of the cradle and of the pond of the canal is raised up and leaves the communication betwixt the water in the canal and the cradle free, and the boat swims in or out of the cradle. The cradles are balanced by very strong chains running over three cast-iron wheels, and are so arranged that the water in the upper cradle is about two inches below the level of the water in the pond, the consequence of which is, that the upper cradle has a slight preponderance, just sufficient to set the machinery in motion; the weight of this additional water being generally about one ton; it may, however, be regulated at pleasure. The principle of action is always maintaining the equilibrium between the cradles, is the well known one, that a floating body displaces a volume of fluid equal to its own weight. The cradles, when full of water, or when either or both of them contains a boat, will balance in any position; an additional weight of water in the descending cradle being necessary just to overcome the friction and the vis inertiæ of the machinery and cradles. It is obvious that the weight of the additional length of the suspending chains on the side of the cradle which is the lowest must be counterbalanced; this is effected by attaching to the under side of each cradle a chain of equal weight per foot with the suspending chains; and this, elongating under the ascending, and shortening under the descending cradle, removes the disparity in weight. The strength of materials is the great desideratum in machinery of this nature; and though the lifts here described are but forty-six feet, and the boats about eight tons, yet the same method is applicable to much greater heights and much heavier tonnage. The advantages of these lifts over common locks are great economy of construction and great saving of time and water, the time occupied in passing one boat up and another down this lift of forty-six feet being but three minutes, whereas in common locks to pass the same height would occupy thirty minutes. Also the quantity of water consumed is about two tons for eight tons of cargo, whereas in common locks it is about three tons of water per ton of cargo.

From the London Repertory of Patent Inventions.

Specification of the Patent granted to John Macneill, *of Parliament Street, in the County of Middlesex, Civil Engineer, for Improvements in Making or Mending Turnpike or Common Roads.*—Sealed January 11, 1837.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said John Macneill, do hereby declare the nature of my said invention, and the manner in which the

same is to be performed, are fully described and ascertained, in and by the following statement thereof (that is to say):—

My invention consists of an improved method of applying iron in the construction of roads, as will be hereafter fully described. I proceed, when making a new road, to obtain a suitable surface, and bring the same to a condition for laying on gravel or broken stones of various descriptions, suitable for making a strong hard surface for the passage of carriages and horses, as has heretofore been practised in making roads, but in place of completing the upper surface of the road with gravel or broken stone, or a combination of gravel and broken stone, as heretofore, I apply a quantity of pieces of wrought, or cast-iron mixed with broken stone, for the purpose of making a more hard and complete surface to roads, the pieces of iron may be of any shape that will bind in the road, but I prefer cubes of about one inch. The quantity of iron to be used with the broken stone or gravel will vary, depending on the degree of hardness and strength desired to be obtained to the surface of the road. Having laid the road with broken stone as heretofore practised, whether for a new road or an old one, I lay the pieces of iron in such a manner that they shall be from one inch to three inches from each other, depending on the strength required. By this means when by rolling the surface or by the ordinary traffic, the surface of the road has become consolidated, such surface will for the most part be composed of pieces of iron, which by oxydizing and otherwise, will bind fast with the other materials of the road, and produce a much harder and more solid surface than when broken stone or gravel alone is used. I would remark, that I am aware that attempts have been made to use iron in large blocks to pave roads in place of, and in like manner, to the blocks of granite commonly employed, though I believe without success. My invention does not, however, relate to paving of roads with blocks of iron, but only to the use of iron in dimensions assimilating to the broken stone or gravel with which it is combined.

Having thus described the nature of my invention, and the manner of carrying the same into effect, I would have it understood that what I claim, is the mode above described, of combining iron with ordinary road making materials for giving solidity and strength to roads as above described.—In witness whereof, &c.

Enrolled July 7, 1836.

Specification of the Patent granted to Henry Huntley Mohun, *of Walworth, in the County of Surrey, M. D. for Improvements in the Manufacturing of Fuel.*—Sealed October 4, 1836.

To all to whom these presents shall come. &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Henry Huntley Mohun, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof (that is to say):—

My invention consists in combining certain materials into fuel, as will be hereafter described, whereby I am enabled to produce a cheap and highly useful fuel. The materials employed by me are:—

First, Peat-earth, peat-turf, peat-moss, in slimy or other mud, or marl, or any any other earth which is composed largely of vegetable matter. Secondly, nitre. Thirdly, alum. Fourthly, linseed or other seeds, or shelled fruit Fifthly, rosin. Sixthly, coke. Seventhly, any green vegetable matter; and, Eighthly, animal excrement, or other animal matter;

and in order to give the best information in my power for carrying out the invention, I will describe a process of combining these materials into a fuel.

Description of the process of combining and pressing the Materials into Lumps of Fuel.

Take one ton of peat in its raw or charred state; 30 lbs. of nitre, (the crude nitre does best); 14 lbs. of alum, which has the effect, when properly dissolved and thoroughly amalgamated with the rest, to prevent smoke; 14lbs of linseed; 14lbs. of resin, or asphaltum, or naptha; 150lbs. of coke; 168lbs. of green vegetable matter; 156lbs. of animal excrements, or other animal matter. Note. The quantity of the various materials will depend on the quality of the peat-earth, peat-turf, peat-moss, slimy or other mud, marl, or any other earth, which is composed largely of vegetable matter, and the above quantities are given for peat of the best quality, and in order to determine the relative quantities for any particular earth, it will be necessary to weigh out varying quantities, and having mixed, pressed, and dried them, to burn the same, in order to ascertain which mixture produces the description of fire desired; having thus tested the quantities required by any particular peat-earth, peat-turf, peat-moss, slimy mud, marl, or any other earth composed largely of vegetable matter, the process of mixing may be proceeded with for large quantities. The peat is first to be passed through the mixing mill, in a dry state, and the mill employed is an ordinary pug-mill, such as is used in brick-making; about one-third, or half, of the linseed is to be boiled in water, in order to produce a liquid about the consistency of thin glue: in this the alum is to be dissolved, the remainder of the linseed with the rosin and nitre, are to be crushed very fine, by edge stones or other means, and the green vegetable matter is also to be ground or crushed in like manner, and thus produce a pulp, taking care to keep the vegetable juices from running away. The whole of the materials are then to be mixed with spades, or otherwise, well ground in the pug-mill, the object being to obtain an intimate blending of the various materials, in order to the same burning equally. The combined mass thus so produced, is then to be pressed in moulds, by a strong screw, or other press, the shape and dimensions of the lumps not being material, but it is desirable the materials should be well pressed, in order to prevent the lumps readily coming to pieces; if well pressed, the fuel will be apt to crumble, and burn too fast if exposed to a strong draft; but I claim the combination, whether the same be submitted to pressure or not, the advantage of pressing being to increase the time it takes consuming. The lumps thus produced, are to be piled one on the other, leaving spaces between for the circulation of the atmosphere, and it will facilitate the preparation, to have such piles in a closed shed or room, the atmosphere of which can be heated, though in summer time, and in warm dry weather, this will not be necessary, unless great expedition is required; care must be taken not to expose it to a great artificial heat, when just formed or pressed. It must be dried by the atmosphere only, for the first two or three days. Note. The peat, it should be observed, may be first used for the purposes of distilling gas therefrom, as has been before practised, and the charred peat in the retorts, subsequently used for the making of the fuel, in place of the raw peat, as above described; and in order to make the new fuel, for the purpose of obtaining gas therefrom, for illuminating purposes, take in the proportion of 10 lbs. of nitre, 40 lbs. of rosin, 24 lbs. of linseed, 1 cwt. of green vegetable matter, 1 ton of peat, which being combined, and

treated according to the directions above given, and the lumps put into ordinary gas retorts, and distilled similar to ordinary coal.

Having thus described the nature of my invention, and the manner of combining the same, I would remark that I do not confine myself to the precise three processes here described, for it will be evident that the object to be obtained, is a careful combining or mixing of the materials herein-mentioned, and the subsequent pressing the same into hard lumps, of convenient size; and whether such processes are conducted as above described, or by any other convenient means, it does not alter the nature of my invention; and I would remark that I do not claim the application of each of the eight parts or materials separately as a fuel, whether pressed or unpressed; some of them, such as the peat-earths, or peat-turf, peat-moss, and coke, and some others, have been used for fuel before; and note: the green vegetable matter is most useful as soon as possible after cutting, and when the vegetable juices are not dried up. Nor do I confine myself to the using the whole, or even the larger number of the eight matters above-mentioned into one fuel, though I believe the same to be the best compound; but what I claim is, the combining and pressing such materials into fuel, as above described.—In witness whereof, &c.

Enrolled April 3, 1837.

Specification of a Patent granted to William Hancock, *of Windsor Place, City Road, in the County of Middlesex, Gentleman, for Certain Improvements in Book-Binding.*—Sealed December 7, 1836.

To all to whom these presents shall come, &c &c.—*Now know ye*, that in compliance with the said proviso, I, the said William Hancock, do hereby declare that the nature of my said improvements in book-binding, consists in attaching or binding the leaves of books together by applying caoutchouc, or solutions of caoutchouc, or caoutchouc partly in the sheet state and partly in a state of solution, in such manner to the backs of the said leaves, that sawing and sewing the same is rendered unnecessary, and books so bound are made to open perfectly flat, or more nearly so, than books bound by any other method heretofore in use; and also in applying caoutchouc in the said states, and in such manner to the backs of the sheets of books after they have been sewn or stitched in the usual way, as greatly to improve the same in point of solidity and elasticity. And the manner in which the same is performed, I shall now proceed to describe. Having folded the sheets of which the book is to consist, according to the determined size thereof, whether folio, quarto, octavo, or any other form, and assorted, made up, beat, and pressed, the same as is ordinarily done preparatory to sewing by the common method, I place them in a cutting-press between two cutting boards with just so much of the backs of the sheets projecting from the upper edges of the boards that, on cutting away the same, which I next proceed to do with the ploughing knife, the leaves of each sheet are separated and detached at the back from one another. The surface left by this ploughing process being commonly smooth, I make it a little rough either by rubbing it with sand paper, or by rasping it with a book-binder's grater or rake; sometimes also, I avoid altogether such smoothness of surface, by employing instead of the ordinary ploughing knife, a tooth plane with a very fine serrated edge. Immediately after cutting and before shifting the mass of leaves from the cutting-press, I apply to the back surface so cut and

prepared, a coating of a solution of caoutchouc obtained by dissolving sheet caoutchouc in pure spirits of turpentine, in the proportions of a pound of the former to a gallon of the latter, or thereabouts. When the said coating is dry, I add a second coating of the same solution, and when that has also dried, I lay on a strip or band of caoutchouc cloth, which cloth I make by spreading a solution of caoutchouc obtained in the manner herein before mentioned upon linen, woollen, cotton, silk, or any other flexible material adapted to the purpose of book-binding. To cause this strip or band to adhere firmly to the back, I apply it in a warm sticky state, and then rub or press it on with the hand. The mass of leaves of which the book consists will now be found so firmly cemented together, that they may be removed from the cutting-press, and the boarding and finishing proceeded with in the ordinary way. Instead of ploughing away the whole of the backs of the sheets as aforesaid, two, three, or any greater number of broad grooves may be cut therein, at equal distances and just deep enough to go through all the folds that may be one within the other, and having coated the whole, the plain as well as grooved parts, twice over with a solution of caoutchouc as before directed, I insert in the said grooves cross bands of the caoutchouc cloth made as aforesaid, the ends of which cross bands I attach to the boards or covers of the books in the usual manner. Instead of employing a back band consisting of cloth or some other flexible material coated with a solution of caoutchouc; I sometimes find it convenient to make use of the sheet caoutchouc in its undissolved state, superadding thereto a coating of the solution. I find also that in the case of books in folio sheets, and of books in quarto when made up in half sheets, and of books in octavo when made up in quarter sheets, and generally of all leaves when in a simply duplicate state with a back of one fold, such sheets and leaves may be very securely cemented and bound together without any cutting or ploughing at the back, by applying caoutchouc in any of the states or modes aforesaid to the backs of such sheets or leaves, after the same have been assorted, made up, beat, and pressed, as aforesaid, for the purpose of binding. When a book is composed of leaves originally single, I plough and rasp them in the manner before described, and when such leaves are of large dimensions, such as plates or maps, I attach to the back edge of each by means of a solution of caoutchouc obtained as aforesaid, a strip of cotton or other suitable material of such size that it overlaps the leaf to the extent of about a quarter of an inch on each side, and then make up and bind together the sheets so individually prepared, in the manner hereinbefore directed for binding books of other descriptions. I find also that when books are sewn or stitched in the usual way, the solidity and elasticity of the backs thereof are greatly improved by applying thereto caoutchouc or solution of caoutchouc in the manner hereinbefore directed with respect to books consisting of quarter or other sheets with backs of only one fold.

And having now described the nature of my said invented improvements in book-binding, and the manner in which the same are to be performed, I declare that I do not claim as new, or of my invention, the employment of caoutchouc in book-binding, but that I claim as new and of my invention the employment of caoutchouc in book-binding in the manner and modes hereinbefore set forth, so that the sheets or leaves of books are in some cases bound together without sawing and sewing, and books so bound open perfectly flat or more nearly so than books bound by any other method heretofore in use. And in other cases where books are

sewn or stitched in the usual way, the backs thereof are greatly improved in point of solidity and elasticity. And I claim as comprehended under my patent any and every other mode or manner of employing caoutchouc to produce the new and useful effects aforesaid, which shall involve no material departure from the manner hereinbefore specified. And such my invention being to the best of my knowledge and belief entirely new and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland called England, his said dominion of Wales or Town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects with the proviso in the said hereinbefore in part recited letters patent contained; wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled June 7, 1837.

Simple Letter Copying Machine. By N. S. Heineken.

The object of this contrivance is to afford to the traveller a portable instrument for copying letters, &c. It consists simply of a brass tube 14 inches long, and $1\frac{1}{4}$ diameter. One end, which has a bottom soldered into it and a cover fitted to it, contains a small bottle of copying ink. To the inside of the cover of the other end is attached a brush for the purpose of damping the paper. The space between is occupied by sheets of copying paper, together with some oiled paper and thick blotting, or filtering, paper in a cover. To use the instrument it is only necessary to place a sheet of copying paper between the leaves of blotting paper which have been previously wetted with the brush, and to let it remain till sufficiently damp—or, more expeditiously, to damp the copying paper itself with the brush and allow the dry paper to absorb the superfluous moisture. Place the paper thus prepared upon the letter, &c, and over it a piece of oiled paper and roll the whole tightly upon the outside of the brass tube which may be then rolled under the hands upon a table; a copy may thus be readily taken off. The tube also serves the purpose of a ruler.—*Lond. Mech. Mag.*

Baltimore and Ohio Railroad.

We are pleased to learn, as we do by the annexed notice, that the Baltimore and Ohio Railroad Company are about to resume active operations, and to extend their road to Cumberland.

Engineer's Office, Baltimore and Ohio Railroad.

Contractors for Graduation, Masonry and Bridging, throughout the country, are informed that in all the month of March 1839, the part of the Baltimore and Ohio Railroad between Harpers Ferry and Cumberland is expected to be finally located and ready for contract. The distance between those places is about one hundred miles upon the line of the Railroad, which will lie principally upon the Virginia Shore of the Potomac River.

The Graduation will require the removal of upwards of 3,000,000 cubic yards of material; the bridges will contain about 36,000 perches, and the Culverts and Walls about 107,000 perches of masonry; the aggregate length of the Bridge Superstructures will be about 2,500 feet. The roadbed will be graded for a double track throughout the line. A Tunnel of about 1000 feet in length will form part of the work. As it is intended to press the work forward with great activity, no proposal for any portion of it will be accepted from any person who is not able to give the most satisfactory security for his energetic prosecution of his contract and its faithful performance. The customary specifications and plans of all parts of the work will it is expected be ready at the Office of the Company in Baltimore, about the first of April, 1839. Of this more particular information will be given by timely advertisements. By order of the President and Directors.

BENJ. H. LATROBE,
Engineer of Location and Construction.

From the Charleston Patriot.

To the Public.

Perceiving from the public prints, that an apprehension seems to exist that I am about to relinquish the Presidency of the Louisville, Cincinnati and Charleston Railroad Company, for the purpose of becoming President of the Railroad Bank, I think it proper to state, that I am not a candidate for the latter office, and have no intention whatever of relinquishing the former. The flattering indications of an undiminished public confidence in my official conduct, and the apprehension expressed, that a change in the position I have occupied in relation to the Road, might operate unfavorably, upon the success of our great enterprize, would, if there were no other objections, be conclusive, in inducing me to retain my present position. I regard the success of the Road, as essential to the welfare of the country; and the Bank as the great instrument by which its success is to be secured. The same persons being the proprietors of both, and having a common interest in all their operations, the Bank and the Road should be conducted in perfect harmony, and each be made auxiliary to the success of the other. A contrary spirit must be fatal to both. For my own part, I cannot entertain a doubt that the affairs of the Bank may be so administered as to subserve the purposes of the Road, while at the same time a reasonable income may be secured to the Stockholders on the whole amount of their investments.

That these objects are attainable, cannot be doubted. The Athens Railroad and Banking Company of Georgia, both, I believe, under the Presidency of Mr. Dearing, have been able by a wise and liberal course of policy, to give full dividends, from the profits of the Bank alone, upon the whole capital invested both in the Bank and the Road, and this while two-thirds of the amount paid in, has actually been expended on the Road. The same results may be produced here. I still have undiminished confidence in the ultimate success of the great enterprize in which we are engaged. If sustained by the Stockholders, and supported by the country, we cannot fail. We have gone on so far successfully, and overcome difficulties far greater than any which are now before us. Perseverance is alone necessary to ensure success. ROBERT Y. HAYNE.

Charleston, 13th November, 1838.

Baltimore and Susquehanna Railroad.—At the invitation of the Board of Directors of this Railroad Company, a large number of the gentlemen connected with the municipal government of the city, with some others not so connected, made an excursion on the Railroad, on Saturday to the borough of York. The cars allotted for this excursion, left the outer depot, on Cathedral Street, at a quarter past eight, in the morning, and after several stoppages, as well to give the travellers opportunities of viewing particular parts of the route, as for other and stated purposes, the company arrived at the depot near York, at ten minutes after twelve; being thus four hours, less five minutes, on the way, including all stoppages. Arrived at the depot, the company left the cars, and proceeded on foot along the graduated way of the railroad through that borough to its point of termination east of North George Street, in the direction of the York County Alms House. Having thus made a reconnoissance of the whole line of the railroad, and marked the condition of the work and its style of execution, the company proceeded to the Globe Inn, where they found an abundant entertainment provided for them. After "the rage of hunger was repressed," some of the company sallied out to take a more extended view of the ancient town of York, while many of its good citizens repaired to the Globe Inn, and entered into friendly and social converse with those who remained.

A pleasant hour or two thus passed, and perhaps not unprofitable, as improving the social relations between "Baltimore and York." Shortly after three o'clock, P. M., the main body of the company repaired to the depot, and entering the cars "homeward bound," returned to the city in good season the same evening. A small number of the company remained in York until next day, being apparently too well pleased with the place, to be content with a visit of a couple of hours. These returned in the regular daily cars the following afternoon.

So far as we heard, the company were much pleased with their excursion on the railroad, and very generally and highly pleased with the substantial manner with which the work had been executed. With the exception of the portion in which the first rail was used at the commencement, it is believed to be one of the best and most substantial roads in the country.

Although laboring under the great inconvenience and disadvantage of being yet unfinished at each extremity, and thus occasioning difficulties, both to travel and transportation, which will cease, on the road being extended into the city, and to the permanent depot at York; the amount of the travel upon the railroad already, is understood to be quite encouraging.
—*Baltimore Patriot.*

Railroad to Pittsburgh.—The Harrisburgh Telegraph of the 30th ult. says: "We are pleased to learn by the Pittsburgh Times, that the Engineers employed to examine the route for a railroad from Chambersburgh to Pittsburgh, have reached the city, and report that a railroad can be made between the two points without an inclined plane. We hope the day is not far distant when a person can get into a railroad car at Philadelphia, and not get out until he gets to Pittsburgh or Erie, unless he choose. The Pittsburgh road will probably be made first."

We trust that the citizens of Philadelphia, who are deeply interested in this important work, will take immediate measures to bring it to the attention of the Legislature at the commencement of the session, in order that the road may be brought to completion as early as practicable. Our rival

cities, New-York and Baltimore, are adopting the most efficient measures to secure the great western trade. Shall Philadelphians quietly look on and see this great trade diverted from them? We hope not, but that our citizens will be up and doing.---*Amer. Sentinel.*

Beautiful Railroad Cars.—The cars intended for night travelling between this city and Philadelphia, and which afford berths for twenty-four persons in each, have been placed on the road, and will be used for the first time to night. One of these cars has been brought to this city, and may be inspected by the public to-day. It is one of the completest things of the kind we have ever seen, and is of beautiful construction. Night travelling on a railroad is, by the introduction of these cars, made as comfortable as that by day, and is relieved of all irksomeness. The enterprise which conceived and constructed the railroad between this city and Philadelphia, cannot be too highly extolled, and the anxiety evinced by the officers who now have its control, in watching over the comfort of the passengers, and the great expense incurred for that object, are worthy of praise, and deserve, and we are glad to find receive, the approbation of the public. A ride to Philadelphia now, even in the depth of winter, may be made without inconvenience, discomfort, or suffering from the weather—you can get into the cars at the depot in Pratt-street, where is a pleasant fire, and in six hours you are landed at the depot in Philadelphia! If you travel in the night you go to rest in a pleasant berth, sleep as soundly as in your own bed at home, and on awakening next morning find yourself at the end of your journey, and in time to take your passage to New-York if you are bent there! Nothing now seems to be wanting to make railroad travelling perfect and complete in every convenience, except the introduction of dining cars, and these we are sure will soon be introduced.—*Baltimore Chronicle, Oct. 30.*

New Haven and Hartford Rail Road.—Some eight to ten miles of our Rail Road to Hartford being completed, and the Locomotive and Cars being in readiness, the Agent and Directors, with a small party of gentleman, made a short excursion this morning to try the quality of the materials and test the susceptibility of motion. At ten o'clock, two cars, with the locomotive, started and proceeded as far as the bridge in North Haven, a distance of about seven miles. This was performed, on the upward stretch, in 25 minutes, and in the downward in 19, without any effort at extra speed. Every thing worked kindly and happily, showing that the parts of the machinery were properly adapted to the purposes for which they were designed. The rail track is remarkably smooth and easy, the cars elegant and commodious, and there was none of that jerking and jarring motion in starting and stopping that we have observed on other roads. We understand that nearly all the iron has been received to complete the road to Meriden, one vessel being due that has the balance on board. When this is received, a few days will suffice to complete the track, and we shall then look to our Hartford friends to meet us half way. We understand the good word is going on prosperously with them, and we are well assured that their accustomed energy will not leave them in the rear.—*New Haven Herald.*

Cumberland Valley Railroad.—Business is rapidly increasing on this Road, and wagons we understand, are wanted to haul goods from the Depot in this place to Pittsburgh and Wheeling.—*Chambersburg Repository.*